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| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
|--|-------------|----------------------|---------------------|------------------|
| 09/362,808 | 07/28/1999 | HONGYONG ZHANG | 07977/088002 | 7320 |
| 26171 | 7590 | 04/06/2005 | EXAMINER | |
| FISH & RICHARDSON P.C. 1425 K STREET, N.W. 11TH FLOOR WASHINGTON, DC 20005-3500 | | | RAO, SHRINIVAS H | |
| | | | ART UNIT | PAPER NUMBER |
| | | | 2814 | |

DATE MAILED: 04/06/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

| | | | |
|------------------------------|------------------------|---------------------|--|
| Office Action Summary | Application No. | Applicant(s) | |
| | 09/362,808 | ZHANG, HONGYONG | |
| | Examiner | Art Unit | |
| | Steven H. Rao | 2814 | |

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 31 January 2005.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-40 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) 1-13 is/are allowed.
- 6) ☐ Claim(s) 14-40 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|---|---|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | Paper No(s)/Mail Date. _____ |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

Response to Amendment

Applicants' amendment filed on January 14, 2005 has been entered and forwarded to the Examiner on January 31, 2005 .

Therefore claims 1-40 as recited previously (Therefore claims 1, 6,10, 14, 16-19,21,24-26,28,39-40 as amended by the amendment of October 31, 2002 and claims 2-5,7-9,1 1-13,15,20.22-23,27,29-39 as previously recited are currently pending in the Application).

Claims 1-13 and 33-34 were indicated as being allowable in the previous Office Action.

Claims 14-32 and 35-40 were previously rejected.

Information Disclosure Statement

No further IDS have been filed after the one filed on February 14, 2000 in the instant Application.

Allowable Subject Matter

Claims 1,6, 10 (independent) and claims 2-5,7-9,11-13 depending there form are allowed.

The following is an examiner's statement of reasons for allowance:

The prior art taken either singularly or in combination fails to anticipate or fairly

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suggest the limitation of the dependent claims, in such manner that a rejection under 35 U.S.C. 102 or 103 would be proper. The prior art fails to teach a combination of all the claimed features as presented in independent claims, which include a semiconductor device as recited in the independent claims generally and specifically 1, 6 and 10 a third opening in said second interlayer insulating film for exposing said portion of said semiconductor layer, said portion of said gate insulating film and a portion of said first interlayer insulating film which surrounds the second opening and wherein the edges of at least the third opening are rounded off .

Any comments considered necessary by applicant must be submitted no later than the payment of the issue fee and, to avoid processing delays, should preferably accompany the issue fee. Such submissions should be clearly labeled "Comments on Statement of Reasons for Allowance."

Claim Rejections - 35 USC Section 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) a patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made

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A. Claims 14 -18 are rejected under 35 U.S.C. 103(a) as being unpatentable over Fu et al. in view of Sasaki as applied to claims 1,3 and 5 previously, and further in view of Lin et al. (U.S patent # 5,8411,195).

Fu et al. in view of Sasaki show most aspects of the instant invention (in paragraph 2), including an gate electrode 30 formed over the insulating film and on a first interlayer insulating film and a second interlayer insulating film over said insulating film and the gate electrode at one contact hole in said first and second interlayer insulating film the first , second and third opening and connected with one of the source and drain regions through the first, second and third openings (see figure 6). Fu et al. in view of Sasaki do not disclose a tapered angle B of the second interlayer insulating film 21 (called 0) with respect to a major surface the semiconductor layer 10 in the third opening is larger than a tapered angle of the first interlayer insulating film 20 (called a) with respect to a major surface of the semiconductor layer ID layer 20.

However , Lin, a patent from the same filed of endeavor describes in figures 6-7 etc. and col. Col. 3 lines 20-25 and 40-65 describe a tapered angle B of the second interlayer insulating film 16/18 with respect to a major surface the semiconductor layer 10 in the third opening is larger than a tapered angle of the first interlayer insulating film 20/22 (called a) with respect to a major surface of the semiconductor .In view of Lin et al. including in figures 6-7 etc. and col. Col. 3 lines 20-25 and 40-65 describe a tapered angle B of the second interlayer insulating film 16/18 with respect to a major surface the semiconductor layer 10 in the third opening is larger than a tapered angle of the first interlayer insulating film 20/22 (called a) with respect to a major surface of the

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semiconductor, where it is taught that the higher etching rate of an insulating film will produce an angle larger than the angle of another insulating film that has lower etching rate. These angles are the tilt angles of the cross-section a semiconductor device to form contact vias in a semiconductor device by a method performed at low to medium temperatures, without significantly increasing the complexity, resulting in planarized topography add free from /reduced sharp corners.

Therefore it would have been obvious to a person of ordinary skill in the art at the time of the invention to include Lin's a patent from the same filed of endeavor describes in figures 6-7 etc. and col. Col. 3 lines 20-25 and 40-65 describe a tapered angle B of the second interlayer insulating film 16/18 with respect to a major surface the semiconductor layer 10 in the third opening is larger than a tapered angle of the first interlayer insulating film 20/22 (called a) with respect to a major surface of the semiconductor In Fu and Sasaki's device to form contact viasina semiconductor device by a method performed at low to medium temperatures, without significantly increasing the complexity, resulting in planarized topography add free from /reduced sharp corners.

Claims 19-30 and 35-37 are rejected under 35 U.S.C. 103(a) as being unpatentable over Fu et al. in view of Sasaki and Lin et al. as applied to claims 2, 6-18 previously , and further in view of Huang et al (previously applied).

Fu et al. in view of Sasaki and Lin et al. show most the aspects of the instant invention (paragraph 4). except for having a channel region, a low doped impurity region and high doped impurity region being adjacent to the channel region with the low

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doped impurity region interposed between. In figure 1, Huang teaches to use a semiconductor

In claims 22,23,29'and 30, the dosage of dope used' is an intermediate' process step and does not affect the final device structure.

Claims 38-40 recite the same limitation stated above namely, " the thickness of the first interlayer insulating film is less than one-third of the total thickness of the first and second Interlayer insulating films." (see Zhang's description stated above).

Response to Arguments

Applicant's arguments with respect to claims 1 to 40 have been considered but are not persuasive for reasons setout under the rejections above.

Applicants' contention that the applied Fu, Sasaki and Lin references individually or in combination do not describe or suggest "first and second interlayer insulating films including a contact hole formed such that a taper angle 'Beta ' of an inner surface of the second interlayer insulating film in the contact hole with respect to a major surface of the semiconductor layer is larger than a taper angle α of an inner surface of the first interlayer insulating film in the contact hole with respect to the major surface of the semiconductor layer, as recited in claim 14" is not persuasive because Lin in figures 6-7 shows:

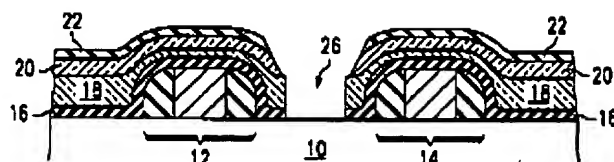


FIG. 6

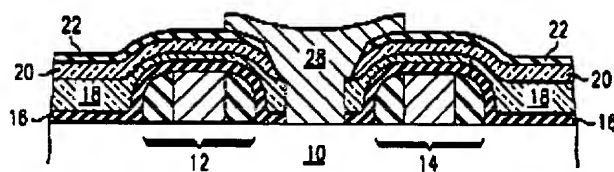


FIG. 7

and Lin col. 3 lines 20-22 state four layers 16, 18, 20 and 22 from an inter level dielectric layers.

It can be clearly seen that layers 16/18 and 20/22 have first and second interlayer insulating films including a contact hole formed such that a taper angle 'Beta' of an inner surface of the second interlayer insulating film in the contact hole with respect to a major surface of the semiconductor layer is larger than a taper angle α of an inner surface of the first interlayer insulating film in the contact hole with respect to the major surface of the semiconductor layer.

Further Applicants' are directed to Lin col. 2 lines 22-26, col. 3 lines 20-25 and 40 to 65.

Therefore Claim 14 and its depend claims 17-18 are Finally rejected.

Applicants' contention w.r.t claim 19 that contact hole in which angles of the tapered section of the contact hole decrease successively from the second interlayer insulating film toward the first interlayer insulating is not persuasive for reasons set out under claim 14 namely Lin figures 6-7 and the description.

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Applicants' contention w.r.t claim 24 that four references would not include the motivation to combine them can be only be responded by stating the motivation to combine them was previously setout (and repeated in the rejection above) and failure by Applicants' to provide specific reasons what the references can not be combined , it can be concluded that there are no sustainable reasons for the references to be not combined.

Therefore dependent claims 20-23 and 25-30 and 35-37 were alleged to be allowable because of their dependency on allegedly allowable claims 19 and 24 , however as seen above claims 19 and 24 are not allowable. Therefore claims 19-30 and 35-37 are also not allowable and finally rejected.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Steven H. Rao whose telephone number is (571) 272-1718. The examiner can normally be reached on Mondays to Fridays 8.00 to 5.00.

The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private P R or Public PAIR. Status information for unpublished applications is available through private PAIR more information

Steven H. Rao

SR
Patent Examiner
March 12/2009

[Signature]
LONG PHAM
PRIMARY EXAMINER